MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2018/2019

PSM0325 – INTRODUCTION TO PROBABILITY AND STATISTICS

(Foundation in Information Technology / Life Sciences)

28 MAY 2019
9.00a.m – 11.00a.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **THREE** pages excluding the cover page and the Appendix.
2. Answer **ALL FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided. All necessary working steps **MUST** be shown.
4. **Statistical table** is provided.

Instruction: Answer all **FIVE** questions.

Question 1 (10 marks)

a. The number of travel advertisements that have appeared in the latest issues of 50 different magazines are given in the table below.

14	15	18	19	19	21	22	23	25	26
26	26	27	28	28	28	29	29	30	31
32	33	33	33	34	34	34	35	35	35
35	35	36	36	37	38	38	38	39	39
39	39	39	40	41	42	42	43	43	43

i. Identify the mode and the median. (2 marks)

ii. Construct a frequency and cumulative frequency distribution with 14 be the lower limit of the first class and the width of each class interval is five. (3 marks)

b. A survey on the small scale business entrepreneurs produced the following frequency distribution.

Age	Number of Entrepreneurs
20 – 24	3
25 – 29	7
30 – 34	19
35 – 39	33
40 – 44	50
45 – 49	39
50 – 54	37
55 – 59	11
60 – 64	10

Find the mean age and the variance. (5 marks)

Question 2 (10 marks)

a. The discrete random variable T has probability function p(t) defined by,

$$p(t)=\begin{cases} kt^2 & ,t=1,2 \\ k(t-1) & ,t=3,4,5 \\ kt & ,t=6,7 \\ 0 & ,otherwise \end{cases}$$ where k is a constant.

i. Show that $k=1/27$. (2 marks)

ii. Find the expected value of the random variable T. (3 marks)

Continued...

b. A box consists of five red markers and four blue markers. A teacher chooses three markers at random from the box. Find the probability that

i. all markers are of the same colour. (3 marks)

ii. 2 blue markers are selected. (2 marks)

Question 3 (10 marks)

a. The life time of LED bulbs produced by a local factory is normally distributed with mean 11.5 months and standard deviation 0.8 months. A bulb is selected at random.

i. Find the probability that the bulb's life time is between 9.5 and 11.5 months. (3 marks)

ii. If the probability that the bulb's life time is less than x months is 0.975, determine the value of x. (2 marks)

b. A life insurance salesman sells on average 3 life insurance policies per week.

i. Find the probability he will sell 2 or more policies but less than 5 policies. (2 marks)

ii. Assuming there are 5 working days per week, what is the probability he can sell at least 2 policies in a day? (3 marks)

Question 4 (10 marks)

a. A company owns six machines that are used to manufacture the shoes. The average duration each machine can operate (in Months) without needing any maintenance work is as follows:

23 22 27 30 25 29

i. List all possible samples of size five (without replacement) that can be selected from the data and calculate the mean for each sample

(3 marks)

ii. Construct the sampling distribution of $\bar{x}$. (2 marks)

b. An industrial designer wants to determine the average amount of time it takes an adult to assemble an "easy to assemble" toy. A sample of 35 times yielded an average time of 19.92 minutes, with a sample standard deviation of 5.73 minutes. Construct a 90% and 95% confidence interval for the mean assembly time. (5 marks)

Continued...

Question 5 (10 marks)

a. Write the null and alternative hypothesis for the following and determine if it is a two-tailed, a left-tailed or a right-tailed test.

   i. A consumer test agency wants to see the whether the mean lifetime of a brand of tires is less than 67,000 km as the tire manufacturer advertises that the average lifetime is at least 67,000 km. (2 marks)

   ii. The length of a certain lumber from a national home building store is supposed to be 3 meter. A builder wants to check whether the shipment of lumber she receives has a mean length different from 3 meter. (2 marks)

b. The average IQ for the adult population is 100 with a standard deviation of 15. A researcher believes this value has changed. The researcher decides to test the IQ of 75 random adults. The average IQ of the sample is 105.

   i. Set up the hypothesis test, H_0 and H_1. (2 marks)

   ii. At the .05 significance level is there enough evidence to suggest the average IQ has changed? (4 marks)

End of Paper

APPENDIX

Formulae:

1.

	Ungrouped data	Grouped data
Mean:	$\bar{x}=\frac{\sum x}{n} \qquad \mu=\frac{\sum x}{N}$	$\bar{x}=\frac{\sum mf}{n} \qquad \mu=\frac{\sum mf}{N}$
Variance:	$s^2=\frac{\sum x^2-\frac{\left(\sum x\right)^2}{n}}{n-1}$ $\sigma^2=\frac{\sum x^2-\frac{\left(\sum x\right)^2}{N}}{N}$	$s^2=\frac{\sum m^2 f-\frac{\left(\sum mf\right)^2}{n}}{n-1}$ $\sigma^2=\frac{\sum m^2 f-\frac{\left(\sum mf\right)^2}{N}}{N}$
Median:		$L+\left[\frac{\left[\frac{\sum f+1}{2}\right]-F_L}{f_m}\right]w$
Mode:		$L+\left[\frac{f_m-f_B}{(f_m-f_B)+(f_m-f_A)}\right]w$

2.

	Mean	Variance
Discrete Random Variable X	$\mu=E(X)$ $=\sum xP(x)$	$Var(X)=E(X^2)-[E(X)]^2$ **where** $E(X^2)=\sum x^2P(x)$
Continuous Random Variable X	$\mu=E(X)$ $=\int_{-\infty}^{\infty} xf(x)dx$	$Var(X)=E(X^2)-[E(X)]^2$ **where** $E(X^2)=\int_{-\infty}^{\infty} x^2f(x)dx$

3.

	Formula	Mean	Standard Deviation
Binomial Probability	$P(x)=\binom{n}{x}p^xq^{n-x}$	$\mu=np$	$\sigma=\sqrt{npq}$
Poisson Probability	$P(x)=\frac{e^{-\lambda}\lambda^x}{x!}$	$\mu=\lambda$	$\sigma=\sqrt{\lambda}$

4. The z value for a value of x: $z = \dfrac{x - \mu}{\sigma}$

5. The z value for a value of $\bar{x}$: $z = \dfrac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}}$

   where $\mu_{\bar{x}} = \mu$ and $\sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}}$

6. Sampling error = $\bar{x} - \mu$
   Non-sampling error = incorrect $\bar{x}$ − correct $\bar{x}$

7. Point estimate of $\mu = \bar{x}$

   Margin of error = $\pm 1.96\sigma_{\bar{x}} = \pm 1.96\dfrac{\sigma}{\sqrt{n}}$ or $= \pm 1.96 s_{\bar{x}} = \pm 1.96\dfrac{s}{\sqrt{n}}$

8. The $(1-\alpha)100\%$ confidence interval for μ is

   $\bar{x} \pm z\sigma_{\bar{x}}$ is known

   $\bar{x} \pm z s_{\bar{x}}$ if σ is not known

   where $\sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}}$ & $s_{\bar{x}} = \dfrac{s}{\sqrt{n}}$